STUDENT PROJECT FINAL REPORT
UNIVERSITY OF HAWAII MARINE OPTION PROGRAM
Shallow Water Fishery Survey of
French Frigate Shoals

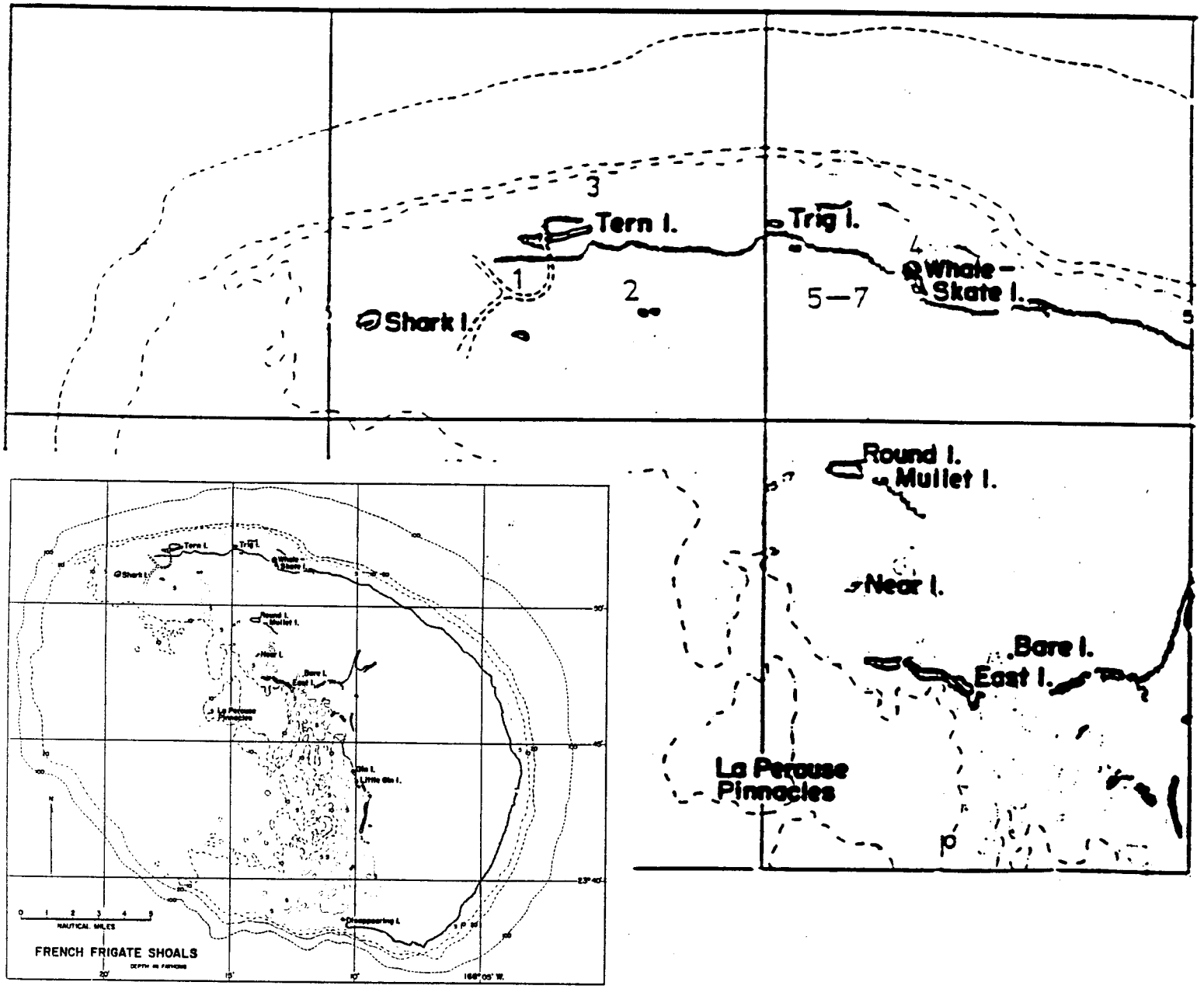
DURATION
June 1, 1992 - July 25, 1992
PROJECT LEADER
Raymond C. Boland
ADVISOR
Frank Parrish, NMFS
FINAL REPORT DATE
July 28, 1992

INTRODUCTION

An assessment of French Frigate Shoals (FFS) reef fish community was undertaken in response to concern that newly weaned monk seals were dying due to limited food availability (Gilmartin, 1988). Possible reasons for a reduction in food abundance include the seal population having reached the atolls carrying capacity, inter-specific resource competition (DeCrosta, et al., 1984; Norris and Parrish, 1988) or more likely, an environmental change due to a possible El Nino. To assess this the National Marine Fisheries Service (NMFS) repeated a fish community census conducted a decade earlier. If significant reduction in fish numbers were detected between the decades then the possibility of limited food abundance would be pursued more actively.

METHODS

In July of 1992 a repeat census of reef fish was done at seven stations at French Frigate Shoals (Fig 1.). The stations were selected and originally censused by the Hawaii Cooperative Fishery Research Unit (HCFRU) in the summer of 1980 (Parrish et al., 1984; Parrish et al. 1985). The stations occurred both inside and outside the atoll's barrier reef, and included patch reefs surrounded by sand and expanses of habitat. Four of the seven stations were expansive in nature and the remaining three



(Figure 1.) Locations of the seven stations surveyed at French Frigate Shoals.

were lagoon patch reefs less than 50 meters in circumference. Compass bearings taken in 1980 were used to relocate the stations and at one station the original 1980 marker block was located. Habitats were examined and compared to 1980 written descriptions to insure similarity of substrates between the two censuses.

Fish census at the expansive habitats was a 50x10m transect conducted with two divers swimming opposite sides of the line censusing successive 5x10m quadrants. At the end of the line the divers switched sides and repeated the transect. On the patch reefs the same procedure was used except 15x10m was sufficient to cover the entire patch reef. Two replicates of each survey were done at each station. Fish were identified to species.

The 80 species observed were collapsed into 8 groups (Table 1.) for both the 1980 and 1992 data sets. The 2 data sets were then compared for every fish group at each of the seven FFS stations. Due to the limited sample size, and the data's non-normal distribution, the conservative nonparametric Kruskal-Wallis (Chi Square) statistic was selected for this analysis. The acceptable significance level was set at probability 0.05. All analysis was done using SAS statistical packaging on an IBM microcomputer. Each of the seven stations were tested for significant differences in fish numbers between the 1980 and the 1992 data.

In attempt to maximize detection of significant differences between 1980 and 1992, the 6 stations located inside the barrier reef were collapsed into 2 categories; combined expansive habitats and combined patch reefs. This would increase the

TABLE 1.

COMPOSITION OF FISH GROUPINGS

GROUPINGS:	FISH IN GROUP:
1) Predators	Caranx, Apogon, Sargocentron, Aulostomids, Scorpanopsus, Scorpaenas.
2) Mullidae	Goatfish
3) Chaetodontidae	Butterflyfish
4) Pomacentridae	Damselfish
5) Labridae	Wrasses
6) Scaridae	Parrotfish
7) Acanthuridae	Surgeonfishes
8) Balistidae/Tetraodontidae	Triggerfish and Pufferfish

sample size and the strength of the Kruskal-Wallis test. The station outside the barrier reef had no habitat replicates with which to collapse, so it was left out of this analysis. If a significant value is achieved further analysis will be done to determine which fish groups indicate differences in numbers.

RESULTS AND DISCUSSION

Of the seven stations, none were found to have significant probability values (P-values), or values less than the dictated .05 significance level (Table 2). Because of this we accept our null hypothesis stating the numbers of fish between decades are not significantly different (Fig 2.). Similarly the collapsing of stations into their habitat categories to increase sample size showed no significant differences in numbers of fish (Table 2).

This studies analysis of the entire community allows no examination of individual species variation. However, detection of species specific variation was not this survey's goal. The specifics of monk seal diets have yet to be discovered so no specific fish was singled out for census. Instead we attempted to identify an impact to the entire fish community that an El Nino might cause.

Further work might include exploring whether the habitats

Table 2.
Kruskal-Wallis P-values
(Chi Square)

Habitat	Station	P-Value
Inside Barrier Expansive Reef	1	0.29
	2	0.09
	4	0.49
Combined Stations of Expansive Reef		0.15
Outside Barrier Expansive Reef	3	0.79
Patch Reefs	5	0.59
	6	0.46
	7	0.34
Combined Stations of Patch Reefs		0.52

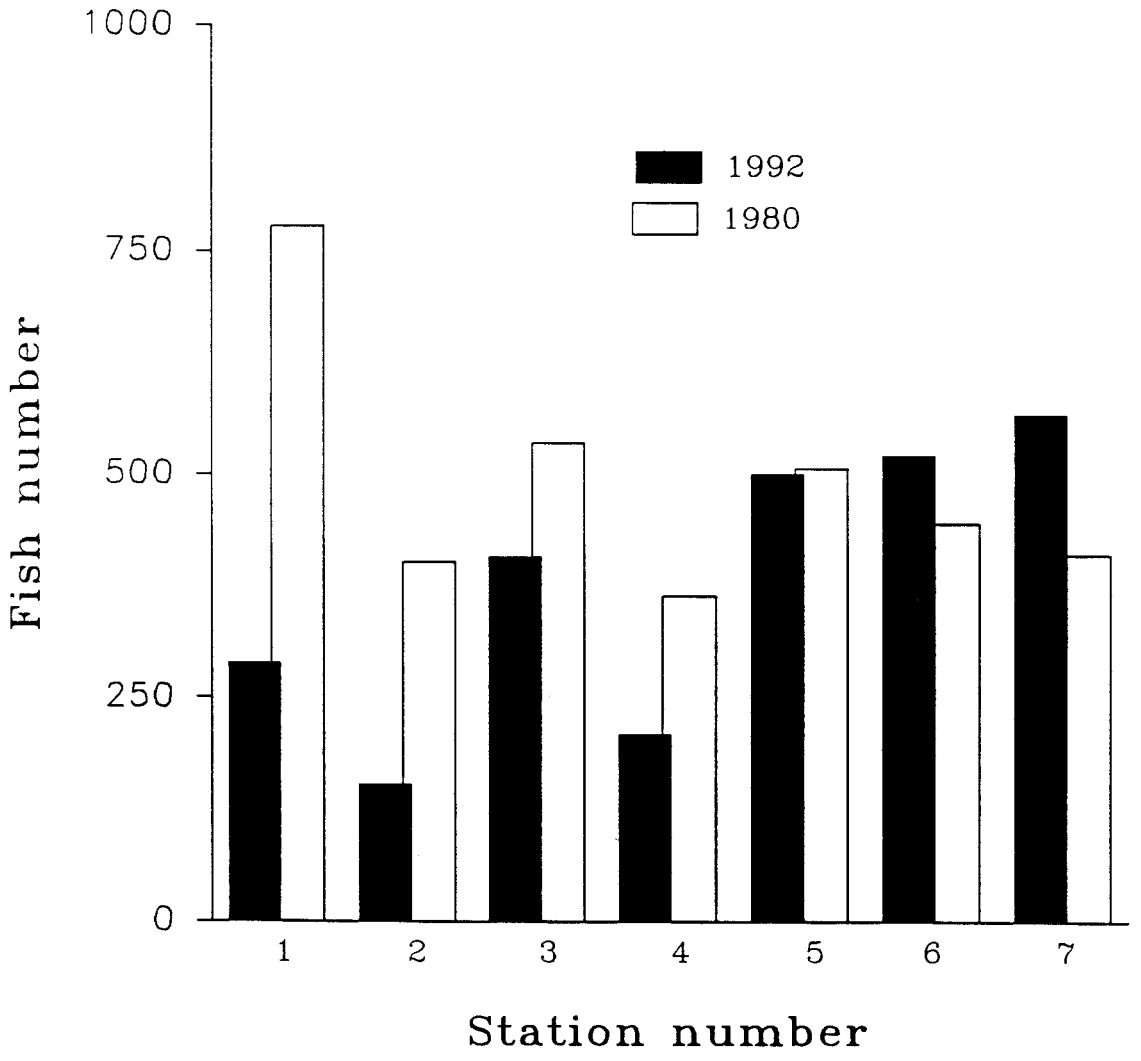


Figure 2. Comparison of fish abundance by station between 1980 and 1992 data sets

respond to environmental or temporal changes independently. Fish community recruitment has been demonstrated to vary with specific habitat (Schroeder, 1987).

CONCLUSIONS:

The lack of significant values does not support a complete failure of reef fish recruitment at French Frigate Shoals. Environmental effects could be playing a role in the perceived problems but further work would be required to confirm this. Further work should include size estimates of fish to be able to determine relative biomass. However, such data were not made available to me.

REFERENCES

DeCrosta, M.A., L.R. Taylor, and J.D. Parrish. 1984. Age determination, growth, and energetics of three species of carcharhinid sharks in Hawaii. Proc. 2nd Symp. Resource Investigations Northwestern Hawaiian Islands. Vol. 2. Univ. Hawaii Sea Grant Miscellaneous Report UNIHI-SEAGRANT-MR-84-01. 75-95 pp.

Gilmartin, William G. 1988. The Hawaiian Monk Seal: Population status and current research activities. Southwest Fish. Cent., Honolulu Lab., Natl. Mar. Fish Serv., NOAA, Honolulu, HI 96822-2396. Southwest Fish. Cent. Admin. Rep. H-88-17, 14 pp.

Norris, J.E. and J.D. Parrish. 1988. Predator-prey relationships among fishes in pristine coral reef communities. Proc. 6th International Coral Reef Symposium 2: 107-113.

Parrish, J.D., M.W. Callahan, J.M. Kurz, J.E. Norris, A.E. Sudekum, G.Y. Akita, J.W. Banta, A. Chun, S.K. Coffee, M.A. DeCrosta, S.D. Feldkamp, A.E. Henry, C.J. Lau, W.G. Lyle, E.J. Magarifuji, T.J. Mirenda, S.L. Sanderson, R.E. Schroeder, M.H. Seigaku, A.C. Solonsky, C.T. Sorden, L.R. Taylor Jr., and A.K. Tomita. 1984. Trophic relationships of nearshore fishes in the Northwestern Hawaiian Islands. Proc. 2nd Symp. Resource Investigations Northwestern Hawaiian Islands. Vol. 1. Univ. Hawaii Sea Grant Miscellaneous Report UNIHI-SEAGRANT-MR-84-01. pp. 221-225. (Abstract)

Parrish, J.D., M.W. Callahan, and J.E. Norris. 1985. Fish trophic relationships that structure reef communities. Proc. 5th International Coral Reef Congress. 4:73-78.

Schroeder, R.E. 1987. Effects of patch reef size and isolation on coral reef fish recuitment. Bull. Mar. Sci. 41(2):441-451.